stituted and provided for by law, and continue the control of seacoast telegraph systems, except wireless systems.

That all meteorological reports from vessels of war or commerce, or other sailing craft, now being forwarded direct to the Hydrographic Office of the Navy, shall be forwarded direct to the Weather Bureau.

That the estimates for the support of the Hydrographic Office of the Navy, or any other office of the Navy, for the next and succeeding years, do not contain any provision for the making of ocean forecasts, or for the publication of meteorological data, other than such as may be needed by the Hydrographer of the Navy for use on the pilot and other charts, which data shall be furnished by and credited to the Weather Bureau.

That it is the opinion of this board that no meteorological work need or should be done by any portion of the Navy for the purpose of publication or for the making of forecasts or storm warnings; that all such duties, being purely civil, should devolve upon the Weather Bureau of the Department of Agriculture in accordance with the organic act creating that Bureau.

That the wireless stations of the Navy shall, without charge to the Agricultural Department, receive and promptly transmit to the ocean or to islands, or to other places where the information can be made useful, the storm warnings of the Weather Bureau.

That the Navy Department shall request all vessels having the use of its wireless stations for the receipt of messages to take daily meteorological observations of the weather when within communicating range and to transmit such observations to the Weather Bureau, through naval wireless stations, at least once daily, and transmit observations oftener when there is a marked change in the barometer, and that there shall be no charge against the Agricultural Department for these observations or for the transmission thereof.

C. A.

TEMPERATURE OF THE UPPER ATMOSPHERE.

The most important congress of scientific men that has ever been held will convene in St. Louis under the presidency of Prof. Simon Newcomb on September 18–25. Meteorology will not occupy a very prominent place in this convention, owing to the inability of several distinguished men to accept the invitation to be present; fortunately, however, one of the most distinguished authorities in cosmical physics, Prof. Svante Arrhenius, is to be present, and his address will probably be as important as was the recent publication of his volume of lectures on this subject. During his preliminary travels in this country this eminent scientist seems to have spent some time at the Lick Observatory, where he has written a paper, dated August 1, "On the Physical Nature of the Solar Corona," which is published as No. 58 of the bulletins of the Lick Observatory. In this he shows that both optical, photographic, and bolometric measurements harmonize in showing that the dust particles of the corona, or the drops of liquid particles of molten metals, if such they be, should, by reflecting the sun's light and heat, produce just the phenomenon that we actually observe, and lead to an approximate determination of the total mass within a cubic meter of the substance of the corona. At the close of this bulletin Arrhenius makes the following remark with regard to the temperature of the earth's atmosphere as deduced from analogous calculations relative to the dust in our atmosphere as warmed up by radiation from the sun and the earth, but cooled by their own radiation into space. Nothing is said by him about the conduction of heat between this dust and the adjacent air. If that would be allowed for, the train of argument would be more complete.

It is often supposed that the outermost layers of the sun are of an exceedingly low temperature, due to the adiabatic dilation of the sun's gases from their vertical circulation. Just in the same manner one calculates that the highest strata of the earth's atmosphere should have an exceedingly low temperature.

The spectroscopic evidence for the sun gives a totally different idea of the temperature in its upper strata. This depends upon two circumstances. The radiation of the sun is extraordinarily strong. In the higher strata the density and consequently the heat capacity of the gases sink to the lowest limit. Therefore their expansion, with the lowering of the temperature in ascending, is wholly overwhelmed by the strong radiation, and we may calculate the temperature as determined by the radiation alone, as we have done above, without committing any sensible error.

This probability also holds good for the uppermost extremely thin strata of the earth's atmosphere, especially on the insolated side of the earth. These highest strata contain particles of cosmical dust, supposed to swim by help of the repulsion of their negative electric charges from the electric charge of lower strata. On account of the insolation, the temperature of these dust particles reaches about 57° C. if the temperature of the soil below is about 30° C.,[1] as is easily calculated by the formula of Stefan. Also, on the night side of the earth, by the radiation of the earth, these particles will get a temperature $\sqrt[4]{2}$ times lower than that of the soil. If this is assumed to be 15° C., one finds, for the dust particles in the highest strata, —31° C. Now, one has observed much lower temperatures in lower strata up to about 20 kilometers. It is, therefore, probable that our atmosphere at a certain height reaches a minimum of temperature, and that at higher strata the temperature again increases. Especially is this valid for the insolated part of the earth, on which the highest temperatures, according to this opinion, occur in the highest strata of the atmosphere, and not, as is generally supposed, in the lowest layers of it.

These conclusions are in excellent agreement with the results of the most modern researches, by Teisserenc de Bort and Assmann, of the temperature of the highest investigated strata of the air.

PRECIPITATION IN WISCONSIN.

Mr. W. M. Wilson, Section Director, Milwaukee, Wis., communicates copies of an address on the work of the United States Department of Agriculture and another on the work of the United States Weather Bureau, delivered by him at the Farmers' Institute held at Oconomowoc, Wis., in March, 1902. These are published in Bulletin No. 16 of the Wisconsin Farmers' Institute, and seem to have attracted favorable attention. In the course of the latter address, Mr. Wilson defended the idea that there has been no material change in climate since meteorological records began to be kept in the State of Wisconsin. By this he explained that he referred especially to the annual rainfall and its fluctuations. Thus he finds from the record of thirty-six years at Beloit that during the last ten years the precipitation has been decidedly more than for the first ten years of this period. On the other hand, the record for thirty-nine years at Manitowoc shows that the average precipitation for the last ten years of this period is decidedly less than for the first ten years. It is, therefore, impossible to infer that there has been any change in the annual rainfall for Wisconsin.

A discussion of this subject by those present at the institute brought out the view that this was not a satisfactory conclusion; that, in fact, we may have the same number of inches of rainfall at different periods and yet have a change in the climate. Annual rainfall is not the controlling climatic consideration. The climate may have changed so far as concerns its influence in the growth of corn and other special matters in which farmers are interested. Mr. Reitbrock stated that fifty-five years ago we considered Waterford, 25 miles south of Milwaukee, as the northern limit of the corn belt. But now we know that corn can succeed on the Lake Superior slope of the Penokee range of mountains. A climatic change has been going on, due to the fact that this territory was all forests in former years and the sun could not melt the ice and snow as rapidly as it can now. The ground warms up more rapidly in the southern part of the State since the timber has been all cut off. The value of rainfall to the crops depends upon seasonal distribution and the frequency of showers in the growing season. A few inches of moisture in summer properly distributed may raise a crop where twice the amount in one or two heavy storms may leave us with no crop.—*C. A.*

CANNONADING AGAINST HAIL.

Among the special commissions in the war office of the French Government is one on powder and saltpeter. This commission has lately published a memoir in which there appears, among other things, a report by Angot on the experiments made to prevent hail by cannonading. Although this subject has been settled as far as American practise is concerned, and will doubtless soon be buried and forgotten in

[1] Above a soil of 0° C. it would be 47° C.

Europe, yet some useful information can be drawn from the experiments. The vortex rings of smoke and air fired from the special tubes designed by Steiger and Suschnig at Windisch-Feistritz in southern Styria are very beautiful examples of hydrodynamic phenomena. When the vortex rings are shot vertically upward they, of course, enlarge their diameter and dimensions, while the velocity diminishes, falling to about one-half at the end of the first second, or at an altitude of about 60 or 70 meters, and they finally come to rest at an altitude whose extreme limit is about 350 meters, or 1000 feet, for the largest cannon and the heaviest charge (180 grams) of gunpowder. As the hail falls from much higher elevations than this, we see at once that the smoke vortex can not have a direct action upon it, either mechanical or physical, and we certainly ought not to invoke any mysterious acoustic action following in the line of the ancient myths to the effect that the ringing of bells and the noise of brass bands dissipates lightning and hail.

Dr. E. Vidal proposed to substitute for cannon a form of skyrocket which is guaranteed to reach 500 meters where a charge of 100 grams of powder can be exploded. These cost much less than the cannon, are simpler and less dangerous. If the cannon do any good, these should do better. They are employed only in some portions of France. In general, Angot shows that a more complete investigation of thunderstorms in all their details must be made in order to demonstrate that cannonading or noises have even the slightest effect. A vote was taken by the members of the conference at Graz, concerning which he says that in this vote the vineyardists were generally in favor of shooting as a means of protection, while the scientific men stood out in a very heavy majority against it. At the close of the conference the members visited Windisch-Feistritz and witnessed the cannonading, but, notwithstanding the ardent conviction with which Mr. Steiger explained his ideas, this exposition was far from producing a favorable effect upon the majority of those present. One could not fail to be impressed with the extreme disproportion between the power of the thunderstorm and the weakness of the means employed to combat it.

After some years of infatuation, the question of cannonading against hail seems now to have arrived at a period of calm and rational discussion. The doubt and scepticism that scientists have shown since the beginning have not diminished, but, on the other hand, have increased among the practical farmers and planters.

PASSAGE OF SOUND THROUGH THE ATMOSPHERE.

Under the above title, Prof. C. V. Boys delivered an instructive lecture before the Royal Meteorological Society on March 18, 1903, and we quote the following from the Quarterly Journal for July:

> In consequence of the gradual decrease of density in the atmosphere upward, light does not travel in a straight horizontal line, but is usually curved to the extent of about one-sixth of the curvature of the earth; in other words, it describes a curve in a vertical plane of about 24,000 miles radius. Thus it is that when the sun and moon have just set geometrically they appear just above the horizon. * * * If the ground is very cold and the temperature increases rapidly upward, a diminution of density becomes intensified and light travels in a still more curved path. * * * When the conditions are reversed, and cold air is resting on warm ground, it sometimes happens that the change of density is sufficiently rapid to cause the beam of light to gradually curve the other way and a mirage results. * * * Unlike light, the velocity of sound is not affected by the density of the air, but it is by the temperature. As, therefore, the temperature usually falls with increasing altitude, the usual condition is that sound travels more quickly near the ground than higher up. This will especially be the case on a warm, quiet, sunny day. If, therefore, on such an occasion it were to happen that the air were uniformly stratified in layers of decreasing temperature, sound would not travel in straight lines, but in curved lines, with the concavity upward. One person, therefore, could not be heard well by another at a distance. * * * On the other hand a quiet night, with the ground colder than the air, tends to reverse the curvature of the sound waves, so that the ground does not form an obstruction and sound is heard well. Above all, a gentle wind, imperceptible on the ground, but increasing gradually upward, adds its velocity to the sound velocity one way and subtracts it to the other, and so *up* the wind, the resultant velocity becomes less upward, and sound rays are strongly bent so as to be concave upward and the ground intercepts all the sound. *Down* the wind, on the other hand, the velocity is greater upward, and rays starting possibly at a number of different inclinations from a source of sound may, after some miles, all converge on a listener, and so he may observe acoustical looming to the amazing extent that we sometimes experience.

THE WEATHER OF THE MONTH.

By Mr. W. B. STOCKMAN, District Forecaster, in charge of Division of Meteorological Records.

PRESSURE.

The distribution of mean atmospheric pressure is graphically shown on Chart VIII and the average values and departures from normal are shown in Tables I and VI.

The mean monthly pressure was highest over the Ohio Valley and Tennessee, east Gulf States, and the southern portion of the South Atlantic States, where the values ranged from 30.05 to 30.09 inches. Over the middle and southern Plateau regions the mean pressure was less than 29.90 inches, with a minimum mean of 29.75 inches at Yuma, Ariz.

The mean pressure for the month was above the normal in the Atlantic and Gulf States, Ohio Valley and Tennessee, lower Lake region, southern portion of the upper Lake region, the upper Mississippi and lower Missouri valleys, southern North Dakota, and the middle and southern slope, and southern portion of the northern slope regions, with the maximum departures ranging from + .05 to + .08 inch over southeastern Florida, the extreme southern portions of Alabama, Mississippi, and Louisiana, southeastern Texas, southern Missouri, northeastern Arkansas, the northern portions of Mississippi and Alabama, western Tennessee, southwestern Virginia, and West Virginia.

Over the Pacific and Plateau regions and the northern portion of North Dakota the mean pressure was below the normal, with the greatest departure over southeastern and northwestern Montana, northern Idaho, eastern and central Washington, north-central California, and north-central Utah, where the departures averaged from — .05 to — .06 inch.

The mean pressure increased over that of June, 1904, in the districts to the southward of a line drawn from the mouth of Chesapeake Bay northwestward to central North Dakota, thence southward to New Mexico, and thence westward to the Pacific Ocean just to the northward of San Francisco. To the northward of this line the mean pressure diminished from that of the preceding month.

TEMPERATURE OF THE AIR.

The distribution of maximum, minimum, and average surface temperatures is graphically shown by the lines on Chart V.

The mean temperature for the month was slightly above the normal on the Massachusetts coast, and in northwestern Montana, northern Idaho, and Washington, except along the coast and in the extreme southeastern portion. In all other sections the mean temperature was below the normal, the greatest changes occurring generally over the central districts, and the southern Plateau, with maximum departures of —4.0° in north-central Nebraska, and —4.1° in central North Dakota.

Maximum temperatures of 90°, or higher, occurred except in portions of New England, North Dakota, the immediate Pacific coast, and the mountain regions; of 100°, or higher, in the central portions of South Carolina, Georgia, Alabama, and Mississippi, Oklahoma, north-central and portions of the Rio